Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies ***NLM ID:*** *101716117*

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Index Copernicus value = 85.10

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

An *in vitro* study of comparative evaluation of acid etching of Glass Ionomer Cement Surface and resin modified Glass Ionomer Cement on the microleakage of sandwich restorations

Vedanshi Patel[1], Parnashi Purohit[2], Zarana Sanghvi[3], Shraddha Choksi[4], Pruthvi Patel[5], Nishit Patel[6]

[1,2]Pg student, [3,5]Professor, [4]Professor and Head of the Department, [6]Reader,

Department of Conservative Dentistry and Endodontics, Ahmedabad Dental College and Hospital, Bhadaj, Ahmedabad, Gujarat-382115

ABSTRACT:

Background and objective: Despite of mechanical properties of glass ionomer cements, esthetic appearance still limits its use. Thus, the sandwich techniques used to preserve the fluoride release mechanism and the chemical bond provided by GIC and RMGIC. Aim of this study is to evaluate the sealing ability of glass ionomer cements (GICs) and Resin modified GIC used for sandwich technique and to evaluate the effect of acid etching of GIC surface on microleakage at GIC composite resin interface. **Methodology:** Twenty four square shaped cavities will be prepared on the proximal surfaces of 12 permanent human premolars (2 cavities per tooth), assigned to 4 groups (n=6) and restored. Group 1 – conventional GIC will be applied onto the axial and cervical cavity walls, allowed setting for 5 min and37% phosphoric acid etching along the cavity margins for 15 s, washed for 30 s and the adhesive system was applied and light cured for 20 s, and restoration will be completed with composite light cured for 40 s; Group 2 – same as Group 1, except for acid etching of the GIC surface; Group 3 – same as 1, but using a resin modified GIC (RMGIC); Group 4 – same as Group 3, except for acid etching of the RMGIC surface. Samples will be immersed in 1% methylene blue dye at 37°C for 24 h, rinsed for 30 min, then sectioned mesiodistally through the centre of the restoration and restorations will be examined in an optical microscope for dye penetration. **Results:** Results were statistically analyzed by Kruskal-Wallis and chi-square tests (α=0.05). The results suggest that etching of GIC surface before the placement of resin composite does not improve the sealing ability of sandwich technique restorations. **Conclusion and interpretation:** The RMGIC was more effective than GIC at the GIC-resin composite dentin interfaces.

Keywords: Glass ionomer cements; Composite resins; microleakage; RMGIC

Received: 11 September, 2020 Accepted: 16 November, 2020

Correspondence: Dr. Parnashi Purohit, PG Student, Department Of Conservative Dentistry and Endodontics, Ahmedabad Dental College and Hospital, Bhadaj Ahmedabad, Gujarat 382115

This article may be cited as: Patel V, Purohit P, Sanghvi Z, Choksi S, Patel P, Patel N. An *in vitro* study of comparative evaluation of acid etching of Glass Ionomer Cement Surface and resin modified Glass Ionomer Cement on the microleakage of sandwich restorations. J Adv Med Dent Scie Res 2021;9(1):27-30.

INTRODUCTION

The anti- cariogenic property and adhesion to dentin are the most attractive properties of glass ionomer cements. To improve properties of this material such as strength, working time, chemical dissolution, new types of GICs have been developed, such as light cure resin modified GIC (RMGIC). Despite of mechanical properties, esthetic appearance still limits its use[1].

Thus, sandwich restoration techniques used to preserve the fluoride release and the chemical bond provided by GIC and RMGIC and esthetics provided by composite restoration but microleakage has been recognized as a problem in restorative dentistry[6].

MATERIALS AND METHOD

This present study was conducted by Pg students and staff of Department of Conservative Dentistry and Endodontics, at Ahmedabad Dental College and Hospital, Bhadaj, Ahmedabad.

12 human permanent premolar free from caries were collected from Department of Oral and Maxillofacial Surgery, Ahmedabad Dental College and Hospital, Bhadaj, Ahmedabad for the study purpose.

Inclusion criteria include non-carious human permanent premolar teeth and exclusion criteria include Carious teeth cracks, root canal filled teeth and hypoplastic teeth

The teeth were cleaned of calculus, soft tissue and other debris, and stored in normal saline at room temperature.

Two window-like cavities (5mm×3mm×2mm) were prepared on mesial and distal surfaces of each tooth using No. 4 round diamond point at high speed.

The 24 cavities were randomly assigned to 4 groups (n=6) and restored according to the sandwich technique.

Group 1: Conventional Glass ionomer cement was applied onto the axial and cervical cavity walls, allowed to set for 5 min. Acid etching of GIC surface was done using 37% phosphoric acid for 15 s was done, then rinsed with water was blotted. Bonding agent was applied and light cured for 15 s. Completing the restoration with composite resin light using incremental technique and light cured for 40 s.

Group 2: Same as Group 1, except for acid etching of the GIC surface was not done, only cavity walls were treated with etchant.

Group 3: Same as group 1, but a resin modified GIC (RMGIC) was used instead of conventional Glass ionomer cement.

Group 4: Same as Group 3, except for acid etching of the RMGIC surface was not done, only cavity walls were treated with etchant.

Teeth were coated with 2 layers of nail varnish, except for a window area that included the restoration and 1 mm around it.

Then the restored teeth are soaked in 1% methylene blue dye solution for 24 h, then rinsed under running water.

The teeth were then split into two halves using diamond disk with water coolant to separate mesial and distal surface. Then mesial and distal sectioned parts were again split into buccal and lingual halves to check dye penetration.

Restoration were examined in an optical microscope for marginal sealing and leakage.

The maximum degree of dye penetration was calculated according to the following score:

0 = No dye penetration;

1 = dye penetration less than one third of width of cavity.

2 = dye penetration beyond the one third of width of cavity.

3 = Dye penetration include the pulpal floor of the cavity.

STATISTICAL ANALYSIS

Results were statistically analyzed by Kruskal– Wallis test and Chi-square test.

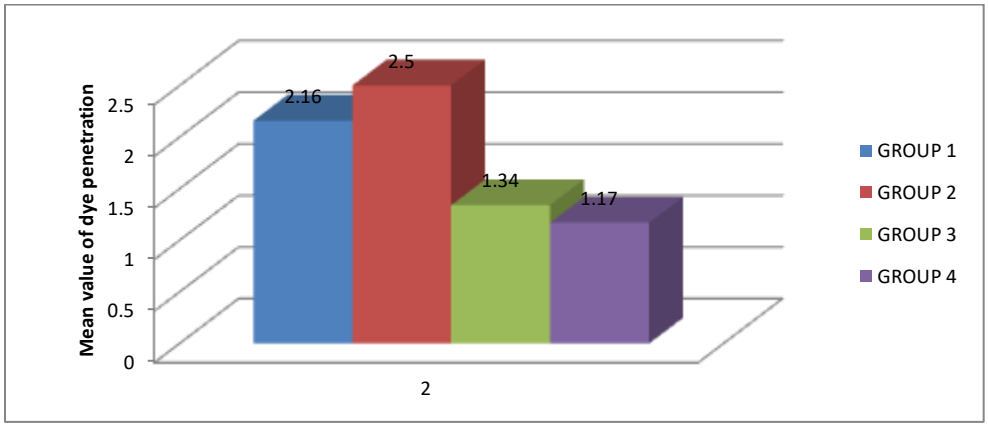
The p value is 0.0031.Which suggest the statistically significant difference between acid etching effect on RMGIC and GIC.

RESULTS

No significant differences were found between Groups 1 and 2 ($p>0.05$), and between Groups 2 and 4 ($p>0.05$) regarding dye penetration means.

Group	Number of teeth	0	1	2	3	Mean
1	6	1	0	1	4	2.16
2	6	0	0	3	3	2.5
3	6	2	1	2	1	1.34
4	6	2	2	1	1	1.17

Table 1 : scoring of teeth in each group and mean value of each group.



Graph showing mean values of dye penetration of each group.

DISCUSSION

The conversion of the monomer molecules into a polymer network causes polymerized shrinkage. Polymerization shrinkage of composite during curing, induces stresses at the tooth restoration interface resulting in gap formation and marginal leakage. Microleakage causes staining at the margin of the restoration, recurrent caries, hypersensitivity of the restored teeth and leading to pulpal pathology.

The use of GIC as base in conventional sandwich restoration reduces the bulk resin composite used, thus, it improves the marginal adaptation and reduces the polymerization shrinkage of the resin composite.

In order to get benefit of fluoride release property of GIC it is used in sandwich technique which also inhibit caries formation and progression around the restoration.[20] The GIC is still considered the only material with self adherence to dental tissue and it has been previously shown that GIC and composite resin can adhere effectively to each other[3,6,9,11], regardless of the limitations concerning this system[12].

The four factors which is responsible for the bond strength between GIC and Composite. 1) the tensile strength of GIC 2) the viscosity and its ability to wet the GIC's surface of bonding agent. 3) The volumetric change is seen during polymerization 4) the difficulties in adaptation of the composite resin to the GIC [12].

The acid etching of GIC would allow a rough surface with high surface energy[11]. This procedure causes a greater interlocked interface between GIC and composite resin [6,9].

In spite of these considerations, the results of the present study indicate that acid etching of GIC and RMGIC surfaces did not improve the sealing ability of sandwich restorations. Between GIC and RMGIC ,RMGIC showed significantly less dye penetration.

No significant differences were found between the surface treatments (Etching and without etching) on same material. The type of GIC selected, significantly affect the outcome of procedure then acid etching of GIC surface.

Conventional GICs fails to produce an effective seal because: 1) sensitivity to moisture during placement and 2) the dehydration which resulting in crazing and cracking [2,10.]

Because of improved mechanical properties and chemical composition of RMGIC it provides better sealing compare to GIC. In RMGIC there is also formation of resin tags into the dentinal tubules allied to the ion. There are no study which shows the presence of these resin tags[17,18], which is the reason for the superior performance of the RMGIC.

In the RMGIC they contain HEMA which helps in the increased bond strengths. and should contribute to prevent dye penetration through the interface of GIC and RMGIC, as shown in this the present study.

CONCLUSION

Within the limitations of this present in vitro study, it shows that etching of GIC before the placement of composite resin does not affect the sealing ability of sandwich restoration. The RMGIC is significantly resistance to dye penetration at the GIC-composite resin-dentin interphase than the conventional GIC.

Further, In vivo long term follow up studies are mandatory to evaluate the better effect of acid etching of glass ionomer cement surface on the microleakage of sandwich restorations.

REFERENCES

1. Bowen RL, Marjenhoff WA. Dental composites/glass ionomers: the materials. Adv Dent Res. 1992;6:44-9.
2. Charbeneau GT. Principles and practice of operative dentistry. Philadelphia: Lea & Febiger; 1988.
3. Fortin D, Vargas MA, Swift EJ Jr. Bonding of resin composites to resin-modified glass ionomers. Am J Dent. 1995;8:201-4.
4. Gupta S, Khinda VI, Grewal N. A comparative study of microleakage below cemento-enamel junction using light cure and chemically cured glass ionomer cement liners. J Indian Soc Pedod Prev Dent. 2002;20:158-64.
5. Hallett KB, Garcia-Godoy F. Microleakage of resin-modified glass ionomer cement restorations: an in vitro study. Dent Mater. 1993;9:306-11.
6. Hinoura K, Moore BK, Phillips RW. Tensile bond strength between glass ionomer cement and composite resin. J Am Dent Assoc. 1987;114:167-72.
7. International Standards Organization. ISO Standard 11405:2003: dental materials-testing of adhesion to tooth structure. Geneva: The Organization; 2003.
8. Loguercio AD, Alessandra R, Mazzocco KC, Dias AL, Busato AL, Singer Jda M, et al. Microleakage in class II composite resin restorations: total bonding and open sandwich technique. J Adhes Dent. 2002;4:137-44.
9. McLean JW, Powis DR, Prosser HJ. The use of glass-ionomer cements in bonding composite resins to dentine. Br Dent J. 1985;158:410-4.
10. Mount GJ. Restoration with glass-ionomer cement: requirements for clinical success. Oper Dent. 1981;6:59-65. 233
11. Mount GJ. Clinical requirements for a successful 'sandwich' - dentine to glass ionomer cement to composite resin. Aust Dent J. 1989;34:259-65.
12. Mount GJ. The tensile strength of the union between various glass ionomer cements and various composite resins. Aust Dent J. 1989;34:136-46. 13- Mount GJ. Adhesion of glass-ionomer cement in the clinical environment. Oper Dent. 1991;16:141-8.
13. Xie D, Brantley WA, Culbertson BM, Wang G. Mechanical properties and microstructures of glass-ionomer cements. Dent Mater. 2000;16:129-38.
14. Nezu T, Winnik FM. Interaction of water-soluble collagen with poly(acrylic acid). Biomaterials. 2000;21:415-9.
15. Pereira LC, Nunes MC, Dibb RG, Powers JM, Roulet JF, Navarro MF. Mechanical properties and bond strength of glass-ionomer cements. J Adhes Dent. 2002;4:73-80.
16. Pereira PNR, Yamada T, Tei R, Tagami J. Bond strength and interface micromorphology of an improved resin-

modified glass ionomer cement. Am J Dent. 1997;10:128-32.
17. Ramos JC, Perdigao J. Bond strenght and SEM morphology of dentin-amalgam adhesives. Am J Dent. 1997;10:152-8.
18. Sidhu SK, Schmalz G. The biocompatibility of glass-ionomer cement materials: a status report for the American Journal of Dentistry. Am J Dent. 2001;14:387-96.
19. Smith DC. A new dental cement. Br Dent J. 1968;124:381-4.
20. Tyas MJ. Milestones in adhesion: glass-ionomer cements. J Adhes Dent. 2003;5:259-66.
21. van Noort R. Introduction to dental materials. Saint Louis: Mosby; 1994.
22. Welbury RR, Murray JJ. A clinical trial of the glass-ionomer cement-composite resin "sandwich" technique in class II cavities in permanent premolar and molar teeth. Quintessence Int. 1990;21:507- 12.